

brous machinery has had to be devised. To summarise and explain this machinery is the aim of the work under notice. In the main it is intended for the food analyst, and the author's idea has been to give this official some information, not only on the subject of food-analysis, but also on various collateral matters with which he is brought into contact. Thus there are sections discussing the equipment of the laboratory, the storage of samples, legal precautions, the duties of the food inspector, and certain processes of food manufacture.

All the ordinary foodstuffs are dealt with, a chapter being allotted to each group of allied products, such as cereals, spices, alcoholic beverages, and so on. The descriptions are written clearly; an excellent selection of the salient facts and the best methods of examination has been made; and to each division an extensive bibliography is appended. Microscope work is a special feature, and the volume is enriched by a series of forty plates, containing about four times as many photomicrographs of the principal vegetable and animal structures met with in the examination of foods.

The chief criticism to offer on the book is that the treatment of so much material in one volume—even one of eight hundred pages—must necessarily be in the nature of a summary. Hence in many instances the information, though sufficient for routine work, is not full enough to be of much value when cases of real difficulty arise.

One notes several examples of careless transcription in looking through the work. On p. 441 the so-called "Koettstorfer's equivalent" for butter-fat is given a maximum value of 241 and a minimum of 253. It might be guessed that these two numbers have been transposed; but on the next page the value of the constant in question is given as 224. The author has, in fact, failed to distinguish between the "equivalent" and the "value" of the saponification experiment. In the table on p. 441 the values of the insoluble acids for oleomargarine are transposed; the specific gravity has no temperature of reference; and a faulty arrangement of the table makes it appear that butter-fat and margarine possess, somehow, a maximum and a minimum temperature; whilst in the data for edible oils and fats on p. 380 the limiting values are again transposed.

Nevertheless, it would be unfair to judge the book by these slips. It contains a large amount of information and, though written more particularly from the American point of view, will be found a useful conspectus of the whole field of food control.

C. SIMMONDS.

THE TRANSPIRATION OF PLANTS.

Die Transpiration der Pflanzen. Eine Physiologische Monographie von Dr. Alfred Burgerstein, A. O. Universitätsprofessor in Wien. Pp. x+283. (Jena: Gustav Fischer, 1904.) Price 7.50 marks.

THIS book is a classified analysis of the published work on transpiration from the time of Hales onward, with a running criticism by the author, who

NO. 1829, VOL. 71]

is well known to have attended to the subject for many years.

The amount of contradictory evidence is remarkable. In the case of the earlier experimenters, with more or less faulty methods, this is not surprising; but the same thing strikes one in many modern instances. The question of the amount of transpiration in moist tropical regions, as compared with Europe, is a case in point. Another instance is what the author describes as a "seven years' war" (1884-1891) between Wille and Lundström as to the absorption of water by the aerial parts of plants. Other disputed points are the effect of salt solutions supplied to the transpiring plants, and the influence of varying amounts of CO₂ in the atmosphere; and many other cases might be cited.

The relation of plants to water, though a subject of primary importance, is still to a great extent in the elementary stage of inquiry. A large number of the statements quoted by Burgerstein are little more than disconnected facts, and, in spite of the interesting book he has made of them, they still seem to us to await a somewhat different treatment.

The subject-matter of the book falls into two classes:—(1) the loss of water-vapour considered as physical phenomenon; (2) the biological inquiry into the adaptation of plants to the distribution of water considered as environment. From both points of view transpiration should be considered side by side with assimilation and respiration, and this manner of looking at the subject has not, in our judgment, been kept sufficiently in mind by the author. The point is that the same organs—the stomata—serve for gaseous exchange and for the evaporation of water. Burgerstein discusses at the end of his book the question whether, as some have supposed, transpiration is a necessary evil. This might have been discussed from a broader standpoint, and would have been in place in an earlier chapter. It does not seem necessary to treat the view referred to as entirely false. Plants undoubtedly have to strike a balance between the possession of a free stomatal connection with the atmosphere and the consequent danger of evaporating more water than they can take up from the soil. This compromise includes also the value of the transpiration-stream in supplying minerals to the aerial parts, on which Burgerstein rightly lays stress. All we suggest is that the whole problem, being of a fundamental character, might well have been dealt with more liberally, and been given a place preliminary to the details of transpiration.

A fault in Burgerstein's treatment of transpiration, though a fault difficult to avoid, is that he does not keep before the reader the fact that the condition of the stomata—whether open, half open, or shut—is far and away more important than all the other internal conditions put together. Like the rest of the world, he is well aware of this, but we doubt whether the un instructed reader would here learn to think of the problem in this way. To take an example, he describes (p. 62) how, when part of the foliage is removed, the remaining leaves transpire more actively than before. Here we want a discussion of the possible effects, direct or indirect, of the operation on the

stomata of the remaining leaves. The same thing is true of the discussion (p. 81) on the transpiration of flowers as compared with leaves, where the reader is left in ignorance of how far the facts are explicable by reference to the stomata.

But it is not merely in relation to isolated problems that we feel the want of more information with regard to the stomata. We should expect to find a full general discussion of their importance in regard to transpiration. This would have included a reference to Horace Brown's work on the static diffusion of gas through these openings, and a consideration of the question how far evaporation can be checked by the closure of the stomata. Again, we should have liked a discussion of the trustworthiness and general value of the microscopic measurements of the stomata in living plants. Burgerstein gives an interesting account of the methods depending on the yield of water-vapour, such as Stahl's cobalt test, &c., by which it can be roughly determined that the stomata are "widely open" or "nearly shut." But if we are to distinguish the stomatal factor from other factors in experiments on transpiration, numerical statements as to the condition of the stomata are wanted, and the question whether such data are available might well have been discussed. With regard to method, Burgerstein seems to us a little hard on the various "potometer" methods, by which a general idea of the transpiration curve is obtained by measuring the intake of water. He is justified in saying that these methods do not estimate transpiration but absorption; but we think he undervalues the fact that, with cut branches and for not too extended periods of time, the intake so closely corresponds to transpiration that the method cannot be neglected, and is certainly of great value for purposes of demonstration.

Though we have criticised "Die Transpiration der Pflanzen," we are far from meaning to condemn it; we have, indeed, read it with interest and profit. Anyone intending to make a study of the subject cannot do better than read it with care. He will thus be made aware of many pitfalls, and will have a guide to the chief points which need fresh investigation.

F. D.

OUR BOOK SHELF.

House, Garden, and Field; a Collection of Short Nature Studies. By L. C. Miall. Pp. x+316; illustrated. (London: E. Arnold, 1904.) Price 6s.

This admirable little work appears to be by far the best aid to the proper teaching of nature-study that has hitherto come under our notice, the author having very wisely refrained from furnishing the teacher with a manual which would do away with all necessity for original study and observation on his part, and enable him to read the various lessons to his pupils without effort or thought. The object of the writer is, indeed, as much to educate the teacher as to enable the latter to teach his pupils. For example, in the article on bananas, Prof. Miall, when he asks the reason for the peculiar shape of that popular fruit, under the guise of leaving the reply to the pupil is really testing the powers of observation and reasoning possessed by the teacher himself.

As the author observes in his introduction, teachers

seem to expect a series of ready-made lessons on a variety of nature subjects, basing their demand on the ground that they have no time (or is it that they have no inclination?) to make the necessary studies for themselves. If this course were adopted, it would lead to two evils. First, all the observations (if they could be so called) would come from the teacher and not from the pupils; and, secondly, knowledge thus acquired by the teacher could not possibly raise the delights of genuine nature-study in the minds of his scholars. Prof. Miall has therefore preferred to make an effort to instil and encourage the habit of observation and inquiry in a few teachers (who will necessarily be the best of their kind) by showing them what may be learnt by careful observation of the common natural objects to be met with among their daily surroundings, rather than by pandering to the popular clamour for cut and dried lessons—which are really not nature-study at all. How he has succeeded remains to be seen. If we may venture to predict, it will be the clever and inquiring teachers who will praise and take advantage of his efforts, and the dullards and plodders who will condemn them and say that they are unsuited to their purpose.

Although the author modestly says that he gives only a few lessons, his articles or essays are no less than fifty-four in number, and cover a very wide range of subjects, including cheese-grubs, glow-worms, water-lilies, London pride, the human face and hand, and museums and their teachings. As an example of the large amount of information Prof. Miall manages to give in a very small compass, we may refer to the exceedingly interesting account of the ancestry and evolution of insects in the chapter on the "cheese-hopper." An excellent work which should be in the hands of all teachers is our verdict.

R. L.

Ideals of Science and Faith. Essays by Various Authors, edited by the Rev. J. E. Hand. Pp. xix+333. (London: George Allen, 1904.) Price 5s. net.

"On all sides" (to quote the preface) "is a growing recognition that the ideals common to both Religion and Science are not only numerous but are indeed the very ideals for which the nobler spirits on both sides care most." Necessarily the treatment is varied, perhaps too varied, but the editor gently deprecates criticism of this feature. Prof. Patrick Geddes has room to discourse on the excellence of teaching boys to make boxes; and the theologians, under "A Presbyterian Approach," "A Church of England Approach," and the like, hardly give one a definite view of "A Christian Approach."

In the papers of the men of science and philosophers the general position is that science does not deal with the whole of life, and that it can no longer meet the claims of faith with a "certainly not." Sir Oliver Lodge defends the idea of continuous guidance on the part of the Deity, seeks to reconcile Pantheism and the belief in a personal God, and complains that religious people seem to be losing some of their faith in prayer. Prof. J. Arthur Thomson and Prof. Patrick Geddes lay stress on the altruistic side of the struggle for existence. Prof. Muirhead maintains that we must limit causation and the conservation of energy to the material world, and must look for some other conception when we come to the action of the mind itself. "We use a saw to make a fiddle; we throw it (*sic*) aside when we come to play upon it (*sic*)." The Hon. Bertrand Russell's paper—"An Ethical Approach"—is the most eloquent; much of it is Lucretius, Book iii., rewritten (could one be more complimentary?), with the difference that Mr. Russell recognises more definitely the need for religion and worship, albeit the worship of a God who is not Force but "created by our own love of the good."